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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/780,682	02/08/2001	Do-Young Lee	000939072310	8252

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EXAMINER

VIEAUX, GARY

ART UNIT PAPER NUMBER

2612

DATE MAILED: 04/07/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b>	<b>Applicant(s)</b>	
	09/780,682	LEE, DO-YOUNG	
	<b>Examiner</b>	<b>Art Unit</b>	
	Gary C. Vieaux	2612	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 12 October 2004.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-14 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-11 is/are rejected.
- 7) ☒ Claim(s) 12-14 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)             | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)    | Paper No(s)/Mail Date. _____  |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____   | 6) <input type="checkbox"/> Other: _____                                    |

## **DETAILED ACTION**

### **Amendment**

The Amendment filed on October 12, 2004 has been received and made of  
5 record. In response to the first office action, the title, as well as claims 1-4 and 6-8,  
have been amended. Claims 9-14 have been added.

### **Response to Amendment**

In response to Applicant's amended title, the Examiner finds the amended title to  
10 be more indicative of the invention to which the claims are directed. Therefore, the  
objection to the title is hereby withdrawn.

In response to Applicant's amendments to claim 2, the examiner finds the  
amended language to more particularly point out and distinctly claim the subject matter  
that the applicant regards as the invention. Therefore, both the objection and the 35  
15 U.S.C. §112 rejection to claim 2 are hereby withdrawn.

In response to Applicant's amendments to claim 6, the examiner finds the  
amended language to provide proper antecedent basis for the claimed subject matter,  
as provided for within the specification. Therefore, the objection to the specification is  
hereby withdrawn.

***Response to Arguments***

Applicant's arguments filed on October 12, 2004 have been fully considered but they are not persuasive.

Regarding claim 1, on page 5 of the Remarks, Applicant submits that claim 1 is  
5 not anticipated by Sakurai, as Sakurai fails to disclose a photodiode having a substantially square shape (Remarks p. 5 line 17 – p. 6 line 2.) The Examiner respectfully disagrees.

Applicant cites Sakurai at col. 4 line 50 and col. 6 lines 22-23 to support the assertion that “[n]umerous passages in Sakurai describe the Sakurai photodiodes as  
10 being rectangular” (Remarks p. 5, lines 22-23.) At col. 4 lines 49-51, Sakurai states “One pixel of a sensor of this type normally has an almost rectangular shape or a shape similar to a rectangle, ...”, At col. 6 lines 22-26, Sakurai states “In the above-described drawings, the photodiode portion PD has a rectangular shape. However, the photodiode portion PD need not always have this shape and can have any shape as far  
15 as the shape allows to maximize the amount of charge to be stored.” Although, as pointed out by the Applicant that nowhere in Sakurai are the photodiodes explicitly described as being square (Remarks, p. 5 lines 21-22), Applicant is also directed to the fact that Sakurai is not found to be limited to photodiodes of strictly of rectangular shape, and provides for “almost” rectangular shaped photodiodes, photodiodes with  
20 shapes “similar to a rectangle”, and photodiodes that “need not always” have a rectangular shape. The referenced citations of Sakurai support an inclusion of a square, as a square is inherently a rectangle, and therefore a square can be found

within the four corners of Sakurai reference to be "almost" rectangular shaped, as well as similar to that of a rectangle. Further, the language of claim 1 calls for a photodiode having a *substantially* square-shaped image sensing area (emphasis added.) The claim language of "substantially" is a broad modifier, and as such, all associated claim

5 language is considered in light of this modifier. A visual inspection of the Sakurai photodiodes illustrated in fig. 12 shows a photodiode that is *substantially* square.

Accordingly, the Examiner respectfully upholds the 35 U.S.C. §102 rejection to claim 1.

Additionally, §2125 of the MPEP provides that drawings and pictures can anticipate claims if they clearly show the structure which is claimed, regardless that the  
10 feature shown is unintended or unexplained in the specification.

Regarding claim 2, Applicant submits that claim 2 is not anticipated by Sakurai, as the Sakurai transistors that are disposed along the sides of a given photodiode are not configured to control the given diode (Remarks, p. 6 lines 3-15.) The Examiner respectfully disagrees.

15 Claim 2 call for the transistors being "*positioned along* at least two sides of the image sensing area" (emphasis added.) It is clear from both figures 7 and 12, as cited in the Office Action of July 14, 2004, the control transistors that are configured to control the photodiode, albeit not directly adjacent, are *positioned along* at least two sides of the image sensing area. Accordingly, the Examiner respectfully upholds the 35 U.S.C.  
20 §102 rejection to claim 2.

Regarding claim 3, Applicant submits that claim 3 is not obvious over Sakurai in view of Guidash, as neither Sakurai nor Guidash show or suggest a lens that is

substantially hemispherical (Remarks, p. 6 line 16 – p. 7 line 3.) The Examiner respectfully disagrees.

The language of claim 3 calls for a *substantially* hemispherically-shaped microlens positioned substantially over the image sensing area (emphasis added.) A visual inspection of the microlens of Guidash illustrated in figs. 1A and 1B, indicator 6, as cited in the Office Action of July 14, 2004, shows a microlens with a cross-section that is *substantially* hemispherically-shaped. Accordingly, the Examiner respectfully upholds the 35 U.S.C. §103 rejection to claim 3.

Applicant also requests that the Examiner indicate the precise language in Guidash indicating that the lens 6 is hemispherical (Remarks, page 6 lines 23-24.) Applicant is once again directed to §2125 of the MPEP which provides that drawings and pictures can anticipate claims if they clearly show the structure which is claimed, regardless that the feature shown is unintended or unexplained in the specification. In light of this section, the Examiner finds that a *substantially* hemispherically-shaped can be found within the drawings of the Guidash reference.

### ***Grounds of Rejection***

#### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the

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applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5

**Claims 1 and 2** are rejected under 35 U.S.C. 102(e) as being anticipated by Sakurai et al. (US 6,633,334).

Regarding claim 1, Sakurai teaches a CMOS pixel for use in a CMOS imager, comprising: a.) a photodiode having a substantially square-shaped image sensing area (Fig. 12 indicator PD1), an anode coupled to ground and a cathode (Fig. 1 indicator PD); b.) a transfer transistor (Fig. 1, indicator MS11) having a drain coupled to the cathode of the photodiode, a gate controlled by a control signal, Tx (Fig. 1, indicator TX), and a source coupled to a floating sensing node; c.) a reset transistor (Fig. 1, indicator MS12) having a drain coupled to a reset potential, a gate controlled by a control signal, Rx (Fig. 1, indicator RES), and a source coupled to the floating sensing node; and d.) a source follower (Fig. 1, indicators MS13 and MS14) coupled between the floating sensing node and an output of the CMOS pixel, the source follower controlled by a select signal (Fig. 1, indicator RES).

Regarding claim 2, Sakurai teaches all the limitations of claim 2 (see the 102 rejection to claim 1 supra), including the teaching by Sakurai wherein the transfer transistor, the reset transistor and the source follower are positioned along at least two sides of the image sensing area (Figs. 7 and 12.)

20

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

5 (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10 **Claims 3-9** are rejected under 35 U.S.C. 103(a) as being unpatentable over Sakurai et al. (US 6,633,334) in view of Guidash et al. (US 5,986,297.)

Regarding claim 3, Sakurai teaches all the limitations of claim 3 (see the 102 rejection to claim 1 supra), except for a teaching wherein the pixel further comprises a substantially hemispherically-shaped microlens positioned substantially over the image  
15 sensing area. Guidash teaches a pixel having a substantially hemispherically-shaped microlens positioned substantially over the image sensing area (Fig.1A and 1B, indicator 6.) It is noted that Guidash also teaches a photodiode having a substantially square-shaped image sensing area (col. 3 lines 32-35 and col. 4 lines 1-2.) It would have been obvious to one of ordinary skill in the art at the time the invention was made  
20 to position a substantially hemispherically-shaped microlens substantially over the image sensing area as taught by Guidash, with the pixel design taught by Sakurai. One of ordinary skill in the art at the time the invention was made would have been motivated to employ this combination of teachings so that light is focused through the microlens onto the image sensing area (Fig. 1A; col. 3 lines 38-41.)



Regarding claims 4 and 5, Sakurai teaches an array, with each pixel comprising a substantially square image sensing region (Fig. 12 indicators PD1-PD3.) However, Sakurai does not teach a substantially hemispherical microlens positioned over the image sensing region of each pixel.

5            Nevertheless, Guidash is found to teach a pixel having a substantially hemispherically-shaped microlense positioned substantially over the image sensing area (Fig. 1A and 1B, indicator 6.) It is noted that Guidash also teaches a photodiode having a substantially square-shaped image sensing area (col. 3 lines 32-35 and col. 4 lines 1-2.) It would have been obvious to one of ordinary skill in the art at the time the  
10   invention was made to position a substantially hemispherically-shaped microlens substantially over the image sensing area as taught by Guidash, with the pixel design taught by Sakurai. One of ordinary skill in the art at the time the invention was made would have been motivated to employ this combination of teachings so that light is focused through the microlens onto the image sensing area (Fig. 1A; col. 3 lines 38-41.)  
15            As to the claim limitations wherein a distance between the image sensing regions of neighboring pixels is optimized to reduce crosstalk between the neighboring pixels or wherein the distance is further optimized to improve MTF, while features of an apparatus may be recited either structurally or functionally, claims directed to an apparatus must be distinguished from the prior art in terms of structure rather than  
20   function. In re Schreiber, 128 F.3d 1473, 1477-78, 44 USPQ2d 1429, 1431-32 (Fed. Cir. 1997.) The instant reference teaches the structural limitations of the apparatus as cited above, and therefore meets the claim limitations as recited.

Regarding claims 6 and 7, Sakurai teaches an imaging array for use in a CMOS imaging system, with each pixel having a substantially square image sensing region (Fig. 12 indicators PD1-PD3.) However, Sakurai does not teach a substantially hemispherical microlens positioned over the image sensing region of each pixel.

5           Nevertheless, Guidash is found to teach a pixel having a substantially hemispherically-shaped microlense positioned substantially over the image sensing area (Fig.1A and 1B, indicator 6.) It is noted that Guidash also teaches a photodiode having a substantially square-shaped image sensing area (col. 3 lines 32-35 and col. 4 lines 1-2.) It would have been obvious to one of ordinary skill in the art at the time the  
10   invention was made to position a substantially hemispherically-shaped microlens substantially over the image sensing area as taught by Guidash, with the pixel design taught by Sakurai. One of ordinary skill in the art at the time the invention was made would have been motivated to employ this combination of teachings so that light is focused through the microlens onto the image sensing area (Fig. 1A; col. 3 lines 38-41.)

15           As to the claim limitations of using the substantially square image sensing region configured to increase the distance between image sensing regions of neighboring pixels, and wherein the position of the substantially hemispherical microlens is configured to increase an effective fill factor, while features of an apparatus may be recited either structurally or functionally, claims directed to an apparatus must be  
20   distinguished from the prior art in terms of structure rather than function. In re Schreiber, 128 F.3d 1473, 1477-78, 44 USPQ2d 1429, 1431-32 (Fed. Cir. 1997.) The instant

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reference teaches the structural limitations of the apparatus as cited above, and therefore meets the claim limitations as recited.

Regarding claim 8, Sakurai and Guidash teach all the limitations of claim 8 (see the 103(a) rejection to claim 7 supra), including a teaching by Sakurai of a pixel

5 comprising: a.) a transfer transistor (Fig. 1, indicator MS11) having a drain coupled to the cathode of the photodiode, a gate controlled by a control signal, Tx (Fig. 1, indicator TX), and a source coupled to a floating sensing node; b.) a reset transistor (Fig. 1, indicator MS12) having a drain coupled to a reset potential, a gate controlled by a control signal, Rx (Fig. 1, indicator RES), and a source coupled to the floating sensing  
10 node; and c.) a source follower (Fig. 1, indicators MS13 and MS14) coupled between the floating sensing node and an output of the unit pixel, the source follower controlled by a select signal (Fig. 1, indicator SEL).

Regarding claim 9, Sakurai and Guidash teach all the limitations of claim 9 (see the 103(a) rejection to claim 8 supra), including the teaching by Sakurai wherein the  
15 transfer transistor, the reset transistor and the source follower are positioned along at least two sides of the image sensing area ('334 Figs. 7 and 12.)

**Claims 10 and 14** are rejected under 35 U.S.C. 103(a) as being unpatentable over Sakurai et al. (US 6,633,334) and Guidash et al. (US 5,986,297), in view of Yang  
20 et al. (An Integrated 800x600 CMOS Imaging System.)

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Regarding claim 10, Sakurai and Guidash teach all the limitations of claim 10 (see the 103(a) rejection to claim 8 supra), except for teaching an array wherein the reset transistor is a depletion mode transistor.

Nevertheless, Yang teaches the use of depletion mode transistors within a  
5 CMOS pixel (p. 304, paragraph 2.) It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the use of depletion mode transistors as the transistors within the array as taught by Sakurai and Guidash, in order to facilitate low-voltage analog pixel operation.

10 **Claim 11** is rejected under 35 U.S.C. 103(a) as being unpatentable over Sakurai et al. (US 6,633,334) in view of Yang et al. (An Integrated 800x600 CMOS Imaging System.)

Regarding claim 11, Sakurai teaches all the limitations of claim 11 (see the 102(a) rejection to claim 1 supra), except for teaching an array wherein the reset  
15 transistor is a depletion mode transistor.

Nevertheless, Yang teaches the use of depletion mode transistors within a CMOS pixel (p. 304, paragraph 2.) It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the use of depletion mode transistors as the transistors within the array as taught by Sakurai in order to facilitate low-voltage  
20 analog pixel operation.

***Allowable Subject Matter***

**Claims 12-14** are objected to as being dependent upon rejected base claims, but would be allowable if rewritten in independent form including all of the limitations of the base claims and any intervening claims.

5        Regarding claims 12 and 13, the prior art does not teach or fairly suggest, in combination with the claims from which dependence is derived, an array in which the distance between image sensing regions of neighboring pixels are at least 3.8 micrometers along a first axis and 4 micrometers along a second axis.

10       Regarding claims 12 and 13, the prior art does not teach or fairly suggest, in combination with the claims from which dependence is derived, an array in which the sides of each CMOS pixel are about 8 micrometers.

***Inventorship***

15       Regarding Inventorship, in the Office Action of July 14, 2004, a clarification by the Applicant regarding a discrepancy in inventorship was requested. To reiterate, the provisional application was found to list the applicants as Oh-Bong Kwon and Do-Young Lee, both of Kyungki-do, Republic of Korea, whereas the nonprovisional application lists only Do-Young Lee. Applicant (Remarks page 7 lines 7-10) points out that the declaration for the non-provisional application lists a single named inventor who signed  
20       the declaration. The Examiner agrees with the Applicant's observation that a single named inventor has signed the declaration of the non-provisional application, however this observation fails to satisfactorily clarify the discrepancies regarding inventorship,

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particularly as the claims provided in the provisional application and whose origin can be associated with two inventors, match verbatim with the claims of the original non-provisional application, but said non-provisional only provides for a single inventor. The Examiner respectfully requests further clarification regarding inventorship, particularly, 5 but not limited to, the roles and relationships of both Oh-Bong Kwon and Do-Young Lee not only to the provisional application, but also to the non-provisional application.

### ***Contact***

Any inquiry concerning this communication or earlier communications from the 10 examiner should be directed to Gary C. Vieaux whose telephone number is 571-272-7318. The examiner can normally be reached on Monday - Friday, 8:00am - 4:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wendy Garber can be reached on 571-272-7308. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

15 Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should 20 you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


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